

The Problem with Problem-Solving Training in Industry

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Abstract: This paper challenges the inherent assumptions reflected in the design and administration of the current problem-solving training model using evidence from empirical research, understanding of the realities of worker's knowledge, skill and ability; the realities of their work environment; and the strong theoretical base within the adult learning literature about adult learners.

Overview

Manufacturing organizations are strategically pushing problem solving and decision making to frontline production employees in an effort to remain competitive. Manufacturing facilities across the U.S. report increasing requirements in open skills such as problem solving (AFL-CIO Working for America Institute, 1999; Applebaum & Berg, 1999; Imel, 1999; National Research Council [NRC], 2001; Schmidt, 2000). To help manufacturing organizations effectively address this growing need among frontline workers, formal problem-solving training programs are being developed and implemented to help them learn how to engage in effective problem solving behaviors on the job.

In this paper, however, I argue that there is a mismatch between the nature of problem solving as it is practiced among frontline workers, and the assumptions reflected in these formal training programs about these workers as learners, their prior knowledge relative to problem solving, and how they acquire expertise in this important area of working knowledge. This mismatch creates a gulf between the expectations and actual performance in resolving workplace problems. With the increased need for workers to solve operational and organizational problems, it is critical that researchers question the underlying assumptions of the current training model through a deeper understanding of the realities of worker's knowledge, skill and ability; the realities of their work environment; and the strong theoretical base within the adult learning literature about adult learners, of which workers are a part. "The blue-collar/managerial divide no longer captures what people do at work. How to adapt practices, institutions, and public policies that rely on this divide or other outmoded images are major issues for future study and action" (NRC, 1999).

I will begin this paper with a brief summary description of current problem-solving training. I will then present the main assumptions which underlie the training, each followed by a challenge to the assumptions using evidence from empirical research, understanding of the realities of worker's knowledge, skill and ability; the realities of their work environment; and the strong theoretical base within the adult learning literature about adult learners. Finally, I develop a conceptual framework that formal training in problem solving might use in fostering more effective problem solving among frontline employees.

Problem-Solving Training in Industry

Today's problem-solving training designed for and administered to frontline employees continues to be strongly influenced by the industrial training model, a model developed from the scientific management approach (Taylor, 1911). The majority of manufacturing organizations continue to operate, in whole or in part, according to this approach. In addition, the language of the industrial training model, "a language of technical rationality for framing their work and 'scientific' strategies for planning learning experiences and assessing their effectiveness" (Dirkx, 1996, p. 43), has been adopted by practitioners of workplace learning programs. The curriculum used in problem solving skills training in industry uses the scientific method of formulating or describing the problem clearly, generating several response alternatives, selecting the best solution, and verifying the effectiveness of the selected solution (D'Zurilla & Goldfried, 1971; Klein, 2001). Though other methods may have more or less steps, they follow the same "rational" method of solving problems. For example, Proctor and Gamble's problem solving approach has been formalized as a process in its "Rational Skills Program," an intensive four week program to provide internal problem solving skills (Spitzer, 1997).

With the scientific management foundation as its guide, the industrial training model, like any model or approach, sits upon a range of assumptions about the nature of the activity, the nature of the environment, and the nature of the participants. The next section describes in detail these assumptions with corresponding evidence which attempts to show that the assumptions no longer match what we believe to be true of the current situation.

Challenging Assumptions

The Nature of Problems

The current problem-solving training model assumes that problems encountered in the workplace are well-structured. The phase or step method assumes that problem solving is composed of concepts, rules, and principles that are called on by the learners when faced with a problem (Jonassen, 1997). In fact, this method was created from research which used well-structured problems. Well-structured problems are problems that (a) present all elements of the problem to the learners, (b) require the application of a limited number of regular and well-structured rules and principles that are organized and predictable, and (c) have knowable and comprehensive solutions where the relationship between decision choices and all problem states is known or probabilistic (Wood, 1983).

However, workplace problems are ill-structured. Problem solving ability and the application of resolving problems in the workplace are extremely complex. Jonassen (1997) suggests that problem solving engages a variety of cognitive and affective components, and that the problems encountered in the workplace are ill-structured. Ill-structured problems are those in which contradictory evidence and opinions exist, for which there is not a single, correct solution (Kitchener, 1983). Problem solving within manufacturing is unsystematic and rather "messy" (Sinnott, 1989). In her study on problem solving processes of individuals of various ages, using the think-aloud method, Sinnott (1989) recognized that respondents' thoughts sometimes worked forward and sometimes worked backward:

He worked out the essence of the problem, the goals, the criteria for selection of goals and solutions, the solutions, and ways around difficult emotional and cognitive points.

Many of his statements dealt with emotions, his past cognitive or emotional history, or his present roles in life; all these factors became part of the decisions about problem parameters or strategies for proceeding in the task. (p.80)

The nature of problems faced within manufacturing as well as the way individuals resolve problems is described by researchers and practitioners as being ill-structured and non-linear.

Transferability to Job Performance

The industrial model assumes that the information presented during training will transfer to the job. Manufacturing organizations spend millions of dollars on formal problem-solving training programs with the expectation that this training will transfer to actual job performance.

However, research informs us that only 10% of what is learned in formal training actually transfers to job performance (Holton, 2002), and most formal problem-solving training efforts do not result in significant transfer to job performance (Broad, 1997). To address this dismal rate of transfer to on-the-job performance (Stolovich, 1997), adult educators have included “real-life” situations in the training sessions which serve to mirror, as much as possible, the same contextual situation that is found on the job. For situations which are predictable and replicable, the training strategy of mirroring contexts may have promise for learning transfer. However, in dynamic, complex environments in which tasks can be relatively undefined and that involve novel and changing demands, the environment in which work tasks are performed is rarely the same as the contexts for which the training design attempts to replicate (Driskell, 2001).

In addition, work-related knowledge and skills gained by employers’ training programs is regarded as important by only a small minority of workers (Educational Development Center [EDC], 1998; Gerber, 1998; Livingstone, 2001). A survey of 900 frontline employees in manufacturing suggests that problem solving is learned informally (EDC, 1998). Hence, the few attempts to demonstrate that individuals trained to solve problems will use their newly learned skills in actual problem solving situations have been mainly disappointing (Carnevale, 2000; Fox & Faw, 2000).

The Manufacturing Environment

The industrial training model was developed during a time when the environment within which work was performed was static and when workers were responsible for only small, routine job tasks, consistent with the scientific management approach to work. Problems encountered on the job were solved by supervision and were most often well-structured and predictable.

The current manufacturing environment, however, is quite the opposite. The environment in which work is currently performed is dynamic and complex, with tasks which are relatively unstructured and undefined and that involve novel and changing demands (Driskell, 2001). In fact, many of today’s manufacturing jobs require complex cognitive skills to deal with more highly technical and sophisticated manufacturing and customer service systems as well as the interpersonal skills necessary to function effectively in work teams (Ford, 1997). Roth (1997) suggests that linear problem solving models fail to account for everyday problem solving because they are ill-suited to the dynamic and generally chaotic conditions of the workplace (Roth, 1997). Current research supports problem solving as a situational and context-bound process that depends on the deep structures of knowledge and experience (Foshay, 1998; Jonassen, 2000; Lave & Wenger, 1991). Open skills, such as problem solving and decision making may proceed through the use of contextual cues that interface with tacit knowledge rather than through the systematic application of explicit steps in the problem solving stage

models (Rogoff & Lave, 1984). Likewise, Hunter (2001) suggests that the current instructional paradigm is incompatible with the open skills domain. In addition, situated, real world problems are emergent and so the problem solver must examine the context from which the problem emerged and determine what the nature of the problem is (Jonassen, 1997). Hence, researchers remind us that it is not productive to try to derive general principles of learning independent of context and content of learning, because the way individuals learn is a function of the way they perceive the learning task and the learning environment (Boud, 1999).

Workers as Learners

In the industrial training model, it is assumed that workers are “empty vessels” which, when filled with information, will automatically return to their jobs ready to fulfill the objectives of the training. This assumption is analogous to the machine/computer metaphor- program it correctly and it will perform as programmed. This model, however, ignores the theoretical underpinnings of what is known about learning and adult learners in the workplace.

Workers have a rich background of knowledge and experience (Livingstone, 2001; Merriam & Caffarella, 1999). Livingston (2001) found, through his extensive study of unionized and non-unionized industrial and service workers in Canada, that workers are increasingly highly educated, increasingly participating in adult education courses and devoting substantial amounts of their time in to informal learning activities outside organized education and training programs. In addition, the study found that industrial workers are generally engaged collectively and individually in an extensive array of employment-related and other informal learning activities that are neither fully recognized by employers nor given prior learning credit by educational institutions. These findings are confirmed by U.S. statistics and other labor demographic research (NCR, 1999). In comparing studies that have conducted empirical assessments of the utilization of knowledge by different occupational classes, Livingstone (1999) found that industrial/service workers and corporate professionals spend similar amounts of time in employment-related informal learning experiences, but that corporate executives, managers and professional employees are much more likely to be enabled to apply their general work-related learning in their jobs. The most recent ASTD State of the Industry Report suggests that training is most successful when training settings and expectations replicate and reinforce real work settings/expectations and when it takes the whole person into account (Thompson, 2001). This suggests that formal training has *not* taken the “whole person” into account- neither their knowledge nor their experience.

The industrial training model also assumes that workers are uneducated, unmotivated and uninvolved. It is interesting to note that the *nature of work* on the manufacturing floor has repeatedly been described by researchers, management practitioners, and the workers themselves as uneducating, unmotivating, and uninvolving (Suzaki, 1993). Could it be that the characteristics of the nature of manufacturing work have in some way transferred to describing the nature of the workers themselves?

The System or the People?

The industrial training model assumes that participants are the “deficit” in the organizational system. Recall that the scientific management approach to work, the foundation of the industrial training model, is one which strives for a perfectly automated “system”, where “effort is simplified (though its pace is frequently intensified) while skill demands are reduced by new methods of task organization and new forms of machinery” (Zuboff, 1984, p. 47). In other words, the individual slowly became the variable factor within the system. Hence, deviations

within the system were thought to be directly related to an individual's performance. Training often was (and still is) the answer to the following question: how do we improve organizational performance? It is this type of thought process which links the need for workers to solve problems with the delivery of problem-solving training.

However, as previously discussed, the linear, logical problem solving models may not fit with the problem solving in everyday situations, not because people are "illogical" but because practical problem solving requires efficiency rather than a full and systematic consideration of all alternatives. Rather than employing formal approaches to solving problems, people devise satisfactory opportunistic solutions. In many cases, the more systematic and precise approach would result in less effective practical action since it would take more effort to develop and would be less flexible in the face of unanticipated opportunities or constraints (Rogoff, 1984). Efficiency is driven by the needs of the organization and so inefficiency should therefore be regarded as an organizational deficit as opposed to a personal deficit.

Conceptual Framework

The industrial training model continues to be the most recognized form of problem solving skills training for workers in manufacturing- such a dominant model is slow to "get off the dime". It seems that the industrial training model is being "held up" by forces which put pressure on this model to change (driving forces) and forces which put pressures on the model to remain the same (restraining forces). A close analysis of these forces would certainly be a worthwhile task as the strengthening of the driving forces with a simultaneous weakening of the restraining forces will undoubtedly produce visible change. Already we see a change in the focus of the HRD practitioners. Rothwell (1999), the leading author of the ASTD report on models for workplace learning, suggests that, because of the new environment of fierce competition and new technologies, human resource development practitioners are shifting their focus *away* from formal training events and toward various types of learning experience. Another force driving change in the industrial model is the current dissatisfaction voiced by workers themselves. Workers are increasingly dissatisfied with the formal education they receive at work and increasingly dissatisfied with how well employers use their knowledge, skills and abilities (Freeman, 1999; NCR, 1999). Further, frontline workers repeatedly state that formal training and other in-house training systems are less effective than the contributions provided through undertaking everyday work activities (Billett, 2001; NCR, 1999). Observing and listening; other workers; everyday activities; and direct instruction, are consistently supported as effective in developing work-related knowledge.

A minority of researchers and practitioners have created alternative approaches to learning in the workplace which are "strengthening the driving forces" toward change. Some focus on creating principles for workplace learning, while others focus on creating curriculums and programs for the workplace. For example, Foshay (1998) suggests several principles which must be foundational for any problem solving learning to occur: problem solving must be taught in the context in which it will be used and learners should be encouraged to ask questions and make suggestions about problem solving strategies they use. Billett (2001), on the other hand, has focused on creating a workplace curriculum called Guided Learning. In this curriculum, co-workers learn from each other. Other examples included resource-based learning (Jung & Leem, 1999), cognitive apprenticeship models (Berryman, 1992), action learning (Rothwell, 1999), and work-based learning (Raelin, 2000). These are only a few examples of "curricula" that strive to

link adult learning theory and the realities of worker capabilities and workplace learning into practice.

Training for effective problem solving in the workplace requires a recognition and integration of the experience and practical knowledge workers already possess with regard to problem solving skills and the socio-cultural contexts of their practice with the working knowledge required by their employers. Such a model of problem-solving training resembles the integrated, theme-based approach to teaching adults (Dirkx, 1997), which grounds the development of academic skills, life skills, and the processes of problem solving, learning-to-learn and critical thinking within the context of particular thematic issues of importance to the learner. This approach uses the *learners themselves as points of departure*. Similarly, the model also reflects the words of Joseph Hart (as cited in Adams, 1975), “If teaching was to have any real share in education, it must learn, somehow, to work inside the experiences of those being taught and not forever hang around on the periphery of experience, piously hoping that something might happen inside” (p. 45), as well as Myles Horton’s (as cited in Adams, 1975) belief that education “happens” when the educator “starts where the learners are” (p. 213).

Conclusion

The current problem-solving training is an incomplete cognitive resource of knowledge as compared to the tangled web of processes that make up everyday problem solving (Martinez, 1998). Rational problem solving methods do not prepare one to improvise, act without all of the relevant information, or cope with unreliable data or shifting conditions (Klein, 2001) of the workplace. In order to define problems and generate novel courses of action, we need to draw on our experience to make judgments about: reasonable goals and their attributes, the appearance of an anomaly, the urgency of solving a problem, what constitutes an opportunity worth pursuing, which analogues best fit the situation and how to apply them, and the solvability of the problem (Klein, 2001). Problem solving is a different phenomenon when we engage in it in natural settings from when we study it under laboratory conditions. For problem-solving training to become an enabling tool for individuals within the workplace, it must align itself with the nature of everyday problem solving, the current realities of workers as learners and the workplace as a learning environment.

References

References available upon request.

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